STRATEGY RESEARCH PROJECT

STRATEGIC WARGAMING: JLASS INTO THE 21ST CENTURY

BY

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ABSTRACT

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The purpose of this study is to develop a Command, Control, Communications, Computer and Intelligence (C4I) plan that allows the United States Army War College (USAWC) to employ or emulate the 21st Century C4I capabilities in support of the Joint Land, Aerospace, and Sea Simulation (JLASS) exercise. The JLASS exercise is a Senior Level College (SLC) exercise jointly sponsored by Industrial College of the Armed Forces, National War College, Army War College, Naval War College, Air War College, and Marine Corps War College. This study examines the strategic wargaming technical capabilities and potential of JLASS, focusing on classified electronic-mail (email) and video teleconferencing (VTC) capabilities when used as distributed collaborative planning tools. The "ends-ways-means" analysis will conclude with a recommendation that the Army War College transition into JLASS wargaming architecture that employs or emulates the 21st Century C4I systems on which students can train in the classroom. This study concludes with a course of action that will integrate SLC classroom education with "real-world" technology and distributed collaborative planning tools.

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The purpose of this study is to develop a Command, Control, Communications, Computer and Intelligence (C4I) plan that allows the United States Army War College (USAWC) to employ or emulate the 21st Century C4I capabilities in support of the Joint Land, Aerospace, and Sea Simulation (JLASS) exercise. The JLASS exercise is a Senior Level College (SLC) exercise jointly sponsored by Industrial College of the Armed Forces, National War College, Army War College, Naval War College, Air War College, and Marine Corps War College. JLASS essentially promotes joint education of all participants by employing joint forces to execute national and theater-level strategies in a credible joint service battle simulation. This study will examine the strategic wargaming technical capabilities and potential of JLASS, focusing on classified electronic-mail (email) and video teleconferencing (VTC) capabilities when used as distributed collaborative planning tools. The "ends-ways-means" analysis will conclude with a recommendation that the Army War College transition into JLASS wargaming architecture that employs or emulates 21st Century C4I systems on which students can train in the classroom. This study finally identifies a course of action that will integrate SLC classroom education with "real-world" technology and distributed collaborative planning tools. This solution will enhance the technical proficiency of future strategic leaders (students).

BACKGROUND

The preeminent joint educational exercise JLASS is annually played at the Air Force Wargaming Institute, Maxwell Air Force Base (Alabama). Seven users from five sites plan for this exercise over a period of six months:

1). Ft. McNair, Washington D.C.: Industrial College of the Armed Forces (ICAF) and National War College.

2). Carlisle Barracks, Pennsylvania: U.S. Army War College.

3). Newport, Rhode Island: Naval War College.

4). Maxwell Air Force Base, Alabama: Air War College and Air Force Wargaming Institute.

5). Quantico, Virginia: Marine Corps War College.

The JLASS exercise scenario is a near simultaneous 2-Major Regional Conflict (MRC) and 1-Limited Regional Conflict (LRC) scenario. In a force-on-force exercise, the National War College serves as the Opposing force (Red force) and all other service war colleges serve as the Blue forces. The exercise plays the East Asia Theater of War, with two theaters of operations: a MRC in Korea and an LRC in Southeast Asia. The second MRC, which precedes the conflict in the Pacific, is set in Southwest Asia and is scripted. The exercise is structured into several phases: first, scenario development and background; second, within each SLC's course curriculum, students prepare their campaign plans in the context of the joint crisis action planning system and controlled by the JLASS Steering Committee; third, following the crisis planning process and student plan submission, faculty controller training is conducted at Maxwell AFB for three days in early April with SLC students arriving on the fourth day to begin the exercise; and fourth, the execution phase allows for five player moves over the next five days. The time step per move is adjusted to insure that each SLC can achieve its desired learning objectives.[1]

Throughout the planning phase (September through March timeframe), distributed collaborative planning tools are used by faculty and students to coordinate and plan JLASS requirements. According to a Harvard Business School Review, collaborative planning tools support work occurring at "any time/any place" using a range of enabling technologies. Video teleconferencing (VTC) technology supports "same time/different place" group work; while electronic-mail (email) supports "different time/different place" group work.[2] Tools are used throughout DoD and during most major force-on-force exercises. In the JLASS exercise, VTC and email are the essential distributed collaborative planning tools for the Blue forces. Direct, one-on-one phone calls complement both student and faculty/controller communication.

As in any large exercise, issues arise that may influence future games and actual operations. Player coordination is essential in this wargame. Blue forces must be able to discuss and resolve planning issues during the academic year. In the current year as in the past, the primary means of coordination was via secure telephone, video teleconferencing, and electronic-mail.[3] Coordination becomes particularly difficult and often times cumbersome with video teleconferencing and electronic-mail, frequently causing delays in the crisis action process.

VTC Problem. The VTC problem arises from the differences in VTC audio-visual equipment among the various colleges, along with equipment down time - which continues to impact on student coordination. While all colleges use Defense Simulation Internet (DSI), this system is cumbersome and sometimes unreliable. Two colleges use the Defense Commercial Telecommunications Network (DCTN), which appears more

dependable than DSI. A single reliable, secure VTC system is essential if JLASS is to emulate existing C4I capabilities and support distributed coordination and gaming.[4]

During the period of September through December, extensive faculty planning occurs by means of VTC and email. From January through March, both faculty and students participate in scheduled VTC sessions to coordinate campaign planning requirements. The Joint Forces Quarterly (JFQ) Summer 1996 magazine article about JLASS addresses such issues; JFQ declares that these faulty systems prevent JLASS students from effectively conducting meaningful staff planning and coordination.[5] The reason for this is that each of the colleges is equipped with different VTC capabilities (Defense Simulation Internet (DSI) and Defense Commercial Telecommunications Network (DCTN)). The Global Command and Control System (GCCS) using the Theater Analysis and Replanning Graphic Execution Toolkit (TARGET) application is expected to be configured with VTC capabilities in a future version. This system, if available at all SLC's, would solve the VTC problem but its fielding plan stretches over many years and is uncertain. Figure 1 depicts the existing VTC capabilities at each of the SLCs.

College	**DSI**	**DCTN**	**GCCS (TARGET)**
Industrial College of the Armed Forces	Yes	No	No
National War College	Yes	No	No
Army War College	Yes	Yes	Yes
Naval War College	Yes	No	No
Air War College	Yes	No	No
Air Force Wargaming Institute	Yes	No	No
Marine Corps War College	Yes	Yes	No

Figure 1. Senior Level College Video Teleconferencing (VTC) Capabilities

The following paragraphs summarize the characteristics of each VTC capability.

Defense Simulation Internet (DSI). DSI was developed by the Advanced Research Project Agency (ARPA) and Defense Information Systems Agency (DISA) to support real-time distributed simulations. DSI's capability to transmit real-time data means it can support video teleconferencing.[6] DSI supports a full range of network services, including file transfers, shared work environment (also called distributed collaborative planning), distance education, internet connectivity, modeling and simulation training, and conference room video teleconferencing. DSI currently extends to each of the Services; to most of the Commanders-in-Chief (CINCs); and to Service schools.[7] Recently, DSI has undergone dramatic changes due to increasing demands for a more robust and stable wide-area network (WAN). The network has been upgraded in both its physical and routing architectures.[8] The high speed data links of the DSI network along with the rapid technological advancements in the field of Asynchronous Transfer Mode (ATM) will provide JLASS customers with information more efficiently and faster. Additional hardware improvements have been made to the video camera, replacing the old "point and shoot" camera with the new PictureTel "pan and tilt" camera, which significantly improves the vision span of the camera and picture quality. In summary, DSI enhancements provide a much improved VTC capability -- both in terms of picture quality and speed of service to its customers.

Defense Commercial Telecommunications Network (DCTN). DCTN grew out of a defense contract with AT&T during the Cold War era to ensure that there was an effective command and control system servicing the Continental United States. DCTN

services include: all Continental United States Defense Switched Network voice services connecting end-office and private branch exchange switches for subscribers. DCTN provides centralized system management functions; significant video teleconferencing services; and direct telecommunications connection lines (point-to-point circuits).[9] The DCTN suite of video teleconferencing systems are room-based, allowing for secure and non-secure video teleconferencing applications in point-to-point, multi-point, and off-net modes of operation. The basic standard system configuration includes monitors with a single chip camera with pan/tilt/zoom/focus capability.[10] In summary, DCTN provides a valuable VTC capability with superb picture quality to its customers.

Global Command and Control System (GCCS). GCCS is an evolving system whose primary mission is to support the warfighter with a global, flexible, and interoperable C4I system. With applications such as Theater Analysis and Replanning Graphic Execution Toolkit (TARGET), GCCS provides a superb planning capability for planners in the JLASS scenario. GCCS incorporates the core planning and assessment tools required by the combatant commanders and their subordinate joint force commanders. Additionally, it meets the readiness support requirements of the services. Designed to support the combatant commanders and subordinate joint force commanders, GCCS uses commercial and government off-the-shelf software applications. GCCS is being implemented at all combatant commands, subordinate components, and at the Service headquarters.[11] GCCS replaces the Worldwide Military Command and Control System (WWMCCS). Video teleconferences will be just one of the many future applications that will be available over GCCS.[12]

Email Problem. The second component addressed is the email problem. The primary difficulty associated with email is the lack of compatibility in protocols in sending and receiving messages among the SLC's. The standard familiar "Internet" requires that all non-American Standard Character Set II (ASCII) data be encoded into a seven-bit format. The two popular methods for achieving this ASCII format are called uu-encoding (an old UNIX standard) and MIME (a newer standard).[13] MIME (Multipurpose Internet Mail Extensions) provides a standardized method for organizing divergent file formats. The MIME protocol is used in Internet communications to transmit documents of varying formats. The protocol handles complexities by establishing a relationship between the format of a document's content and the format of the document's computer representation. Applications using MIME can establish the type of software necessary to interpret the content of a transmitted document.[14] Because various software applications are used at the Senior Level Colleges, delays are often experienced because users must manually encode and decode email messages. For example, at Maxwell AFB a software application that automatically encodes and decodes (without user intervention) had to be installed last year in order to enhance the process of receiving and sending email messages. However, this procedure only corrected the problem for Maxwell AFB, not the entire community of JLASS customers. So, this particular collaborative planning tool (email) can become a cumbersome instrument for both students and faculty. Exacerbating these technical problems for JLASS is the fact that email is unclassified. Some JLASS communication requires greater security under a classified network.

REQUIREMENTS

The basic JLASS requirement is to emulate 21st Century C4I capabilities in a secure mode of operation. Essentially, JLASS seeks to equip the students with the same capabilities they would have in an operational headquarters. The 21st Century C4I capabilities will be addressed in the "Emerging Capabilities" section of this study. Requirements should not be designed as stove piped or stand-alone systems, rather they should be integrated into the overall Joint Architecture. Hence, all players should use the same standards and a common operating environment. Additionally, any computer buys made to satisfy these VTC and email requirements must be Year 2000 compliant in accordance with DoD standards. Recall that we have previously noted that seven users from five geographical sites participate in JLASS. For JLASS to emulate 21st Century C4I capabilities is a complex problem.

VTC Requirements. The following VTC requirements were developed by the JLASS community at the Army War College. These requirements reflect past JLASS experience:

- **Size of population at each site:** VTC population size ranges from 15 to 30 personnel. The VTC would be conducted in either a conference room or a single office.

- **Usage and frequency:** During the period of September through December, weekly VTC's would coordinate faculty planning (either conference or single office setting). From January through March, two to three VTC's per week would focus on faculty and student coordination (either conference or single office setting).

- **Hollywood squares requirement:** This requirement is nice to have, but it's more important to see the site and hear the person speaking.

- **Multiple locations (offices) or single locations (conference room):** Conducting VTC's at a single location is the best option. Conferees would be required to go to the equipment, instead of distributing the conference to the participants.

- **Quality of service:** Quality of service must be equal to that of DCTN or an equivalent capability.

- **Chairman control or voice activated control:** A single reliable, secure VTC is an essential requirement to facilitate student and faculty coordination and planning. The VTC should not require a dedicated employee or operator. The user should be able to operate the system with minimal instruction and no special training.

- **Additional VTC applications:** Should be capable of electronic mail, file transfers of digitized maps and power point slides, shared whiteboards, and pointers.

Email Requirements. The following email requirements reflect the feedback of various Senior Level Colleges surveyed for this study.

- **Automatic encoding and decoding:** The electronic generation, transmission, and display of correspondence and documents will be capable of automatically encoding and decoding email. This allows for the capability to receive documents, spreadsheets, and other non-ASCII data automatically, without manual intervention.

- **Secured network:** Email must be capable of operating over a secured (encrypted) network.

EXISTING/EMERGING CAPABILITIES

Additional capabilities are available today or are emerging to meet the requirements of the 21st Century in the areas of video teleconferencing and electronic mail. With these emerging capabilities, courses of action (COA) will be developed for providing effective collaborative planning tools for the JLASS community. Consider the following capabilities:

Defense Information Systems Network (DISN). The DISN near-term implementation effort is intended to consolidate all DoD data, transmission systems, and networks into a worldwide, common-user seamless network. This network provides connectivity for the Defense Messaging System (DMS) and the Global Command and Control System (GCCS), just to mention two.[15] With the DISN architecture, most Service- and Agency-unique stove pipe networks or stand-alone systems will ultimately be replaced.[16]

Desktop Videos. Desktop computers are currently being equipped with audio and video teleconferencing capabilities. Specifically, these video systems are equipped with a fixed camera, electronic whiteboards, and document-sharing software. The desktop computer's video monitor is being used for the "talking head" pictures of the participants. The video camera operates with a smaller field of vision; however, costs are considerably less than the video room system's camera (e.g., DCTN).[17] These systems are capable of working over the basic-rate of an Integrated Services Digital Network (ISDN) switch (128 Kilobytes/per second or faster). Like DSI, the Asynchronous Transfer Mode (ATM) technology would provide JLASS customers with information more efficiently and faster.

Existing TARGET Software Application with Global Command and Control System (GCCS). The Theater Analysis and Replanning Graphic Execution Toolkit (TARGET) application is an essential collaborative planning tool for contingency and campaign planning. Like desktop video teleconferencing, TARGET will be capable of operating with a video card in future versions of GCCS computer terminal configurations (e.g., Sun SPARC 5, 10 or 20 versions) over the Secret Internet Protocol Router Network (SIPRNET) -- a classified network designed to support DoD systems. Currently, only the Army War College is configured with the SIPRNET to support GCCS. This interactive system application (TARGET) is capable of simultaneously sharing maps, whiteboard (a combination of text and graphics), and file folders. Additionally, TARGET is capable of performing email functions, integrating force lists, and conducting course-of-action analysis functions by means of its "Course of Action Selection Tool"(COAST).

Existing TARGET Software Application without GCCS. As previously discussed, TARGET provides strategic planners with an essential collaborative planning tool for contingency and campaign planning. All parties acknowledge that not everyone in DoD is currently fielded with GCCS. The software application of TARGET can be used outside the network configuration of GCCS if necessary or appropriate. In order to accommodate this software application and the sensitivity of the information, the network must be secured with some type of encryption device such as a KG-194/194A encryption unit or a Secure Telephone Unit (STU) modem. Each transmission channel used by TARGET must be protected by the encryption device. This requires one encryption device at each end of the network. The network as a minimum would consist of the seven

users and five geographical sites. Other than the encryption device, the computer terminal hardware configuration (e.g., Sun SPARC terminal) would remain the same as previously mentioned with GCCS. Additionally, this same approach can be applied to TARGET configured with DSI, using the improved Network Encryption System (NES).

Multipoint Capability. Multipoint teleconferencing is the term given to simultaneous connections of three or more video teleconferencing systems. DoD has long taken advantage of the multipoint capabilities provided by DCTN and DSI. At the higher levels of command, multipoint conferences are commonplace. As the trend toward less expensive hardware and bandwidth on demand develops, desired capabilities like multipoint operation will be expanded. Current multipoint control units are capable of bridging like systems running proprietary protocols or dissimilar systems.[18] With seven users from five geographical sites, JLASS would benefit from using the multipoint VTC capability.

Multilevel Security. Multilevel security is the enabling technology to achieve secure information system integration. Consolidation is being driven by the need for improved mission performance and the need to provide decision-makers with rapid information in a cost effective manner. Two noteworthy approaches are the Multilevel Information Systems Security Initiative (MISSI) and the Network Encryption System (NES). MISSI, a National Security Agency (NSA) initiative, seeks to provide a set of products that can be used to construct secure computer networks in support of a wide variety of missions. Combined, these evolving products provide security services for a wide variety of application environments. MISSI is already providing security products and services to

support the Defense Message System (DMS) email and file transfer applications. With respect to NES, this Motorola family of products provides a flexible network security solution. NES is capable of transmitting Top Secret data over commercial and DoD networks.[19] Because JLASS has the potential (in the 21st Century) of using commercial and DoD networks for VTC and email, multilevel security is an important capability for JLASS.

Defense Message System (DMS). The Defense Message System (DMS) will be the single, seamless, end-to-end global electronic messaging service that meets all DoD messaging requirements. DMS meets the Secretary of Defense guidance to avoid developing unique military standards by implementing internationally developed standards. The Secretary of Defense intends to implement DMS in all DoD environments - strategic, tactical, fixed, and mobile. DMS is a critical, value-added service of the Defense Information Infrastructure and supports command and control, administrative, and intelligence information exchange to enhance readiness and warfighting capabilities. Over the next 5 years, voice mail, facsimile, imagery, and email will be exchanged through DMS as the single DoD messaging system. Additionally, DMS is poised to fully exploit advances in security technology, such as Multilevel Security (MLS) platforms and operating systems.[20] Once DMS is fielded, JLASS will benefit from this capability.

COURSES OF ACTION (COA) ANALYSIS

The following courses of action are feasible options for providing effective collaborative planning tools in the areas of VTC and email. These options will be analyzed in accord with an "ends-ways-means" continuum. The "ends" stipulates the

objectives, or what; the "ways" identify the concept, or indicate how the end will be achieved; and the "means" specify the resources required to achieve the ends. Additionally, the "risk" of each option will be assessed as part of this analysis.

COA 1. That the current VTC and email capabilities (status quo) be retained for JLASS.

COA 2. That desktop commercial-off-the-shelf (COTS) VTC and commercial email capabilities be implemented to support JLASS.

COA 3. That desktop VTC with TARGET software application and DISN/DMS-compliant email capabilities be implemented to support JLASS.

COA 4. That GCCS be fielded throughout the JLASS community.

COA 1 - Current VTC & Email (Status Quo)

The Ends. Under the current configuration of distributed collaborative planning tools, VTC and email serve to provide a method of exchanging information for the purpose of campaign planning and coordination. As shown in Figure 2, the JLASS hierarchy player cells must insure planning and coordination from one level to the next.

JLASS Player Cells
National War College - Opposing Forces
Industrial College of the Armed Forces - U.S. Transportation Command
U.S. Army War College - Combined Forces Command
Naval War College - Pacific Fleet
Air War College - Pacific Air Forces
Marine Corps War College - U.S. Pacific Command

Figure 2. JLASS Player Cells

This coordination is particularly significant between (the blue players) U.S. Pacific Command, Combined Forces Command, Service Component Commands (Pacific Fleet and Pacific Air Forces) and Transportation Command. Since the National War College serves as the Opposing Forces (red player), it has no requirement to coordinate with any of the other schools so long as the other schools are blue players.[21] However, it must be remembered that all JLASS faculty must coordinate.

The Ways. Currently, the key ways of achieving the objectives of distributed collaborative planning are through the use of DSI and DCTN for video teleconferencing and various software email applications such as; Microsoft Word, Power Point, and Excel Spreadsheet, just to mention a few.

In past years, DSI has received less praise and more criticism; JLASS participants often described DSI as "cumbersome and unreliable" with poor video quality. However, recent hardware and software changes to DSI have improved the quality of its video performance. Since the Army War College (AWC) and Marine Corps War College are the only sites equipped with both the DCTN and DSI capabilities, the capability to bridge between these two VTC systems does exist. For example, the AWC frequently bridges with the DSI at the other JLASS schools with minimum degradation. Early scheduling of VTCs into the DCTN studio is the challenge. In order to accomplish the VTC requirements, a large bandwidth, normally the size of a dedicated T-1 path (T-1 = 1.544 Megabytes/per second (Mbps)), is required for video teleconferencing. It is important to remember that only 384 Kilobytes/per second (Kbps), or 6 of 24 channels of a T-1 path, are actually used for VTC.

Given the various email software applications at the Senior Level Colleges, participants are often required to either manually encode or decode the information or purchase software packages that automatically encode and decode email. Such was the case at Maxwell Air Force Base with their procurement of Incognito, an intelligent gateway software package.[22] However, this software application did not remove the problem from all of the schools, since not all players purchased this application. So divergent email applications persist throughout the JLASS community adding "friction" to the communication system.

The Means. The "means", those resources required to support the "ways", are the key ingredient to the entire process. The "means" will dictate the degree of success in achieving the "ends". In this option, monetary funding (dollars) is the essential resource for achieving the "ends-ways-means" of this option. DCTN alone is expensive. According to some estimates, beginning in Fiscal Year (FY) 98 the Senior Level Colleges will pay approximately $110,000 per year for DSI. Accordingly some of the schools have indicated they will discontinue with the DSI services, despite its improvements. The costs to purchase a software email application requiring the same MIME protocols at each site (such as Incognito) is estimated at $2500 - $3000 per JLASS site (less maintenance, training, and computer terminal compatibility).

The Risks. The risks associated with this option are high. By FY 98, there is a strong probability that DSI will be discontinued at many of the JLASS senior level schools. Additionally, since a number of the schools are not willing to sign up to DCTN due to its prohibitive costs (estimated between $20,000 to $65,000 per site), video teleconferencing

is at risk as a collaborative planning tool. Without video teleconferencing, distributed collaborative planning will be significantly degraded and will thereby negatively impact on achieving the JLASS educational objectives.

COA 2 - Commercial-off-the-Shelf VTC and Commercial Email

The Ends. Under this option, the desktop commercial-off-the shelf (COTS) technology will be the primary tool used for VTC. Commercial email will be used to exchange information among the respective player cells and coordinate strategic campaign planning requirements. The JLASS "blue" and "red" player cell relationships will remain the same as in COA 1. But this course of action will include an encrypted network to support commercial systems for both VTC and email.

The Ways. In this option, video teleconferencing is accomplished through desktop commercial video systems with the capability to project over a large screen. A number of commercial vendors have packaged a fixed camera, installed document sharing software, and used the desktop computer's video monitor for the "talking head" pictures of the participants. Video teleconferencing differences are evident in comparison with their bandwidth throughput or connections to other video systems. For example, one commercial system (Vendor A) works with a basic-rate (128 Kbps throughput) Integrated Services Digital Network (ISDN) line or a local area network (LAN). Another commercial system (Vendor B) works over ISDN only – using an enhanced camera system with six ISDN channels, compared with two channels used by Vendor A. Both commercial video systems are capable of operating at 384 Kbps or faster, thereby improving the audio and video quality.[23] Commercial classified email (such as Netscape

or Eudora) can be used as a distributed collaborative planning tool for JLASS users (at each site) so long as it is encrypted or secured.

The Means. The key resources required to support the "ways" of COA 2 include; advanced technological improvements in the area of desktop video teleconferencing, availability of bandwidth, and availability of funding. Already such vendors as Intel Corporation's ProShare Video Conferencing ($1499 per unit), PictureTel Corporation's Live 200 ($1495 per unit), and PictureTel Corporation's Live 50 ($2495 per unit) are making technological advancements over current products.[24] This commercial listing serves as an example of the technology currently available. The costs of procuring commercial email such as Netscape can range up to $4200 per site ($3000 for the Netscape server bundle and $1200 for Netscape one year suite subscription). Additional costs to procure encryption devices can range between $2100 to $2700 for Secure Telephone Unit Modems (STU-1019) and KG-194/194A. Through advances in Asynchronous Transfer Mode (ATM) and improved network designing, more efficient uses of bandwidth are being made available to support operational requirements.

The Risks. With new advancements in the area of desktop video, commercial vendors have already demonstrated that picture quality diminishes with less bandwidth. For example, operating at 128 Kbps throughput, desktop video provides less clarity and a smaller field of vision. However, when connected to 384 Kbps or faster throughput, the audio and video quality are much improved. Additionally, when this same data rate is applied to a room system, the desktop video was on par with the room system's video. Hence, video problems arise when a slower throughput or connection is used.[25] As

previously mentioned, the costs to configure a desktop video system ($1000 to $5000) are considerably less than those for a room size system ($27,000 to $60,000). So desktop video is more affordable. On the flip side, procurement of commercial email systems along with procuring encryption devices to secure the network can substantially increase the costs of a purely commercial video and email option. Thus, implementation of COA 2 is moderate risk unless the JLASS scenario is unclassified -- then it becomes low risk without the cost of procuring encryption devices.

COA 3 - Desktop VTC (with TARGET) and DMS-Compliant Email

The Ends. In this option, desktop VTC configured with TARGET software application is introduced as a new capability for video teleconferencing. Also introduced is DMS-compliant email standards as the tool to exchange email among its respective player cells. Collectively, these systems serve as the distributed collaborative planning tool for students and faculty. This overall architecture will be supported by the DoD standard of a DISN network.

The Ways. Like COA 2, video teleconferencing is accomplished through desktop video with the additional capability of TARGET software application (designed as a stand-alone configuration outside of GCCS). Again, all parties acknowledge that not everyone in DoD is fielded with GCCS. They also concur that configuring desktop video with TARGET provides an invaluable capability to the overall campaign planning process. A proposed TARGET configuration is shown in Figure 3.

HARDWARE	SOFTWARE
Sun System, SPARC20	TARGET
64MegaBytes Memory	Lucid Common
16MegaBytes Memory	Objectivity Run License
VideoPix Image Capture Board	Applix 3.0
Sun Video Camera with Pan & Tilt	Motif 1.2.3
8Milimeter Tape Drive	PicWin
Solaris 2.x Media Kit	Macintosh Application Environment
Solaris 1.1.1 Version B Media	
Cable, Audio/AUI Adapter	

Figure 3. Proposed TARGET Configuration

Through DMS, this option supports standardization and interoperability throughout DoD for email and messaging systems. Advances in DMS technology will further allow for exchange of multimedia messages and attachments. As preplanned security product improvements from the MISSI program are integrated with DMS, classified and multilevel secure messaging will become available. Full Operational Capability for DMS is planned for the Year 2000, when AUTODIN will be phased out and all organizational and individual messaging in DoD is supported by DMS.[26]

The Means. Like COA 2, the key resources required to support this option include advanced technological improvements in the area of desktop video teleconferencing, availability of bandwidth, and availability of funding. As previously mentioned, cost data for desktop video systems range between $1000 to $5000. With technological advancements like Asynchronous Transfer Mode (ATM), more efficient uses of bandwidth are being made available to users; to provide faster and improved network

service in support of operational requirements. As with the previous options, funding will remain a key resource in supporting the "ends and ways" of this option.

The Risks. Given technological advancements in the area of desktop video, stand-alone TARGET, and DMS-compliant email, this option is considered a low risk course of action. As in COA 2, commercial vendors have already demonstrated that picture quality diminishes with less bandwidth. As was the case in comparing 128 Kbps throughput with 384 Kbps – comparison confirmed that the faster the throughput (i.e., 384 Kbps), the greater the improvement in audio and video quality. Hence, video problems arise when a slower connection is used.[27] Again, the costs to configure a desktop video system ($1000 to $5000) are considerably less than a room size system ($27,000 to $60,000), so the desktop is more affordable.

COA 4 - Global Command and Control System (GCCS)

The Ends. In this option, GCCS is implemented as the primary system to support the video teleconferencing and email requirements of JLASS. Configured to operate with a number of software applications, TARGET is an essential distributed collaborative planning tool designed for contingency and campaign planning. As previously mentioned, TARGET will be capable of operating with a video card in a GCCS computer terminal. Additionally, a proposed or anticipated follow-on version of the GCCS fielding plan will include all of the Senior Level Colleges.

The Ways. GCCS is configured with a number of applications (to include TARGET), all of which are designed to support all phases of crisis planning, from situation development through execution. It specifically supports situation assessment,

deployment planning, employment planning, execution monitoring and rapid replanning, force sustainment, and redeployment. TARGET provides decision aids to assist in the analysis and selection of a single COA that will be recommended to the CINC. Once a COA has been approved, TARGET will provide tools to access force lists, plan and monitor deployment, and plan and monitor execution of the COA. With this system, the JLASS community will share standardized, interoperable strategic planning requirements, using the same applications as the CINC's. As previously discussed, GCCS is designed to operate over the Secret Internet Protocol Router Network (SIPRNET) -- a classified network.

The Means. Resources to support the "ways" of this option include finalizing the fielding plan of GCCS (both hardware and software) and continuing to resource GCCS with the necessary funding for the Senior Level Colleges (except for the Army War College, which is already fielded). Estimated costs to complete a TARGET configuration with video capability range from $2000 to $10,000, depending upon the availability of existing components. Additional varieties of real-time collaboration are shown in Figure 4.[28]

Product Type	Data Types Used	Price Range
Group VTC	Audio, Video	$12,000 - $60,000
Electronic Whiteboard	Data	$3000 - $15,000
Desktop VTC	Data, Audio, Video	$1000 - $5,000
Desktop Data Conferencing	Data, Audio	$0 - $750
One-way Broadcast Two-way Audio	Video, Audio	$40,000-$800,000

Figure 4. Additional Varieties of Real-Time Collaboration

The Risks. GCCS implementation offers a low-to-moderate risk course of action. This option is highly dependent upon the fielding plan and funding of GCCS. Unlike the previous options, GCCS was designed for a specific population rather than a DoD-wide population. Currently, this population does not include the Senior Level Colleges; it is limited to the combatant commanders and joint force subordinate commanders. However, senior level schools are envisioned to be added in a follow-on fielding plan. Until then, among JLASS SLC's, GCCS is available only at the Army War College.

CONCLUSIONS/RECOMMENDATION

JLASS is the preeminent joint educational exercise sponsored by the Senior Level Colleges. JLASS essentially promotes joint education of all participants by employing joint forces to execute national and theater-level strategies in a credible joint service battle simulation. Past JLASS exercises have revealed that existing VTC and email are "cumbersome and unreliable" distributed collaborative planning tools for exchanging information. They do not emulate the distributed collaborative planning tools that students will encounter and use in the field. This study has examined these two collaborative planning tools (VTC and email) and developed four courses of action, each with the potential to ultimately emulate the 21st Century C4I systems. The courses of action analyzed included; current VTC (DSI and DCTN) and email configuration (status quo), commercial desktop VTC and commercial email, desktop VTC (with TARGET) and DMS-compliant email, and full fielding of GCCS. Figures 5 and 6 summarize the analysis of these courses of action.

Courses of Action	Capabilities	Costs
Current VTC & Email	-DCTN/DSI video dependent. -Unclassified email. -Divergent email applications.	-DCTN - Up to $65,000. -DSI - $110,000. -Email/MIME - $2500.
Commercial VTC & Email	-Off the shelf VTC. -Encrypted email network. -Commercial email.	-Desktop VTC - $5000. -Encryption - $2700. -Email software - $4200.
Desktop VTC (TARGET) with DMS Email	-Desktop VTC w/TARGET. -DMS compliant email. -DMS equals DoD standard.	-Desktop VTC - $5000. -TARGET - $2000 plus. -Encryption - $2700.
GCCS	-Video card with TARGET. -GCCS network only. -Classified SIPRNET.	-TARGET with Video $2000 to $10,000.

Figure 5. Summary of COA Results - Capabilities and Costs

Courses of Action	Risk Assessments (Risk to D,C,P, Capabilities)	Technology Reasons
Current VTC & Email	High Risk	-VTC future uncertain. -Inadequate email fix.
Commercial VTC & Email	Moderate Risk	-Commercial-off-the-shelf. -Encrypted network.
Desktop VTC (TARGET) with DMS Email	Low Risk	-VTC/email are enhanced. -TARGET is a key tool.
GCCS	Low to Moderate Risk	-GCCS is a viable solution. -Fielding plan dependent.

Figure 6. Summary of COA Results - Risks and Technology

In Figure 5, the salient capabilities of each course of action are identified with their corresponding costs. Recalling the requirements of this study, we stated that the distributed collaborative planning tools must be integrated into the overall Joint Architecture, must be Year 2000 compliant, must be capable of operating over a secure network, and must be affordable. Additionally, these distributed collaborative planning

tools must be free of being "cumbersome and unreliable" for exchanging information. In other words, free of operator intervention for both VTC and email. Therefore, the COA that best achieves the JLASS requirements is the desktop video (TARGET) with DMS email (COA 3).

In Figure 6, the assessment results are based upon their risks in achieving distributed collaborative planning (D,C,P) capabilities. Specifically, these risks are determined by the technological problems anticipated for a given course of action. As we look to the 21st Century, there is a strong probability that DSI video teleconferencing (despite its enhancements) will be discontinued at many of the JLASS senior level schools. Additionally, a number of the schools are not willing to sign up to DCTN due to its prohibitive VTC costs. Therefore, without these two VTC capabilities another option must be selected to support JLASS educational objectives. Given the overall requirement for jointness and DoD standardization in distributed collaborative planning tools, desktop video teleconferencing and DMS-compliant email best achieves these requirements and provides the lowest risk assessment in a classified network. Should the JLASS requirement change from classified to an unclassified scenario, commercial VTC and commercial email would be assessed as low risk vice moderate risk because acquisition costs would not include the encryption devices specified in the matrix. In that case, COA 2 would appear more attractive but whenever possible we should use the DoD communications network envisioned in COA 3.

Therefore, this study recommends that desktop VTC with TARGET software application and DMS-compliant email standards be integrated into the JLASS senior

service college classroom. With implementation of this course of action, the JLASS wargaming architecture will emulate the 21st Century C4I systems.

ENDNOTES

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